

66 Palæarctic, the effect being doubtless mainly due to that exceptionally strong power of flight to which the authors attributed the unusually wide distribution of butterflies belonging to this family. Other still more interesting intruders are the great Danaine butterflies, of which *Anosia plexippus*, the "Monarch," is the best known and the widest ranging, inasmuch as it extends far into Canada. The peculiar interest of these settlers lies in the fact that certain species of the Holarctic fauna have been profoundly modified into mimicry of them, thus proving beyond the possibility of doubt that the invasion is no new thing—like the spread of the great Danaine *plexippus* into the Philippines, the Fijis, Australia, Hong Kong, &c.

The whole of the vast mass of material in these and the great series of companion memoirs is a remarkable testimony to the insight of P. L. Sclater in drawing the outlines of his regions, of Darwin in laying down the principles of geographical distribution in the "Origin," and of Wallace in his masterly development of the subject in his great works on the geographical distribution of animals. These principles have been tested by an appeal to the facts collected with consummate skill and care from the most critical area in the world, and assuredly they have not been found wanting.

The work is printed and brought out in the same beautiful and costly style as the rest of the series. It contains 112 plates, with more than 2000 admirably executed hand-coloured figures representing 1250 species, and nearly 550 uncoloured figures of the structural parts of butterflies.

The total number of species of Rhopalocera recognised in Central America as here defined is 1805, as against 642 in the New-World and 716 in the Old-World segment of the Holarctic belt. Of these 1805, 360 (almost exactly one-fifth) are described as new. A valuable table of genera shows distinctly and at a glance the relative numbers of the species in each of the eight districts of Central America, in South America, in North America and in the West Indies. The extraordinary poverty of the fauna of the latter is well brought out by this comparison.

The classification adopted is mainly that of H. W. Bates in his paper on the insect fauna of the Amazon Valley (*Journal of Entomology*, ii. pp. 175–185, 1864). The Libytheidæ, instead of being included in the Erycinidæ, are kept as a separate family, represented in the area under consideration by a single species. One slight criticism may be suggested; the monograph begins with the most specialised subfamily—the Danainæ, but within the subfamily itself the more specialised group the Ithomiina follows, instead of precedes, the less specialised Danaina.

This vast undertaking has required the cooperation of some of the best living collectors of insects. In addition to the visits of the editors, Mr. G. C. Champion, Mr. H. H. Smith and many others have remained in Central America for long periods of time collecting material for the "Biologia." Great collections, such as those of H. W. Bates and Herbert Druce, have been acquired as a whole and added to the mass of material, which was steadily accumulating for forty years. Wherever Central American specimens could be acquired or borrowed, they have been studied for the purpose of this

great work; the single exception was due to the impossibility of receiving the loan of Plötz's quoted but unpublished figures. It is unnecessary to say anything further of a difficulty thus gratuitously thrown in the way of a memorable advance in zoological science, a great gift, not restricted to any single nation, but conferred upon the learning of the world.

The thorough treatment of the more obscure Central American groups and genera is such as to render the work absolutely necessary for the study of the related species in other parts of the world.

It would be inappropriate to discuss the details of this great monograph at any length on the present occasion, but all naturalists should gain a knowledge of the general results, in part briefly discussed in this article, which are lucidly set forth in the introductory chapter. And every naturalist, before he reaches the end of the record of results and conclusions, will feel how deep is the debt that he owes to the research and munificence which have led to so notable a widening of the boundaries of knowledge.

E. B. P.

PRINCIPLES OF DYNAMICS.

Sur les Principes de la Mécanique Rationnelle. Par C. de Freycinet, de l'Institut. Pp. viii + 167. (Paris : Gauthier-Villars, 1902.) Price fr. 4.

M. DE FREYCINET first became known to the world as the author of a treatise on dynamics of some bulk and repute, which was published in 1858, and the essay before us shows that at the end of his long and distinguished career of active public life his interest in the subject remains unabated. Referring to his publications during the intervening period, we find two relating to dynamics. In 1887, he communicated to the Academy of Sciences (*Comptes rendus*, cv., pp. 903–910) a note containing the rather interesting suggestion that the term "dynamical capacity" should be adopted in the place of the term "density" as derived from dynamical considerations, on the analogy of calorific capacity; also some proposals about units which were not likely to meet with acceptance. He proposed a standard unit of length derived from the value of gravity at Paris, recommending it by the remark that the length of a pendulum can be measured more conveniently than that of a meridian of the earth. In 1896, he published his essays on the philosophy of the sciences, containing some chapters on mechanics.

The book before us gives the impression of not being up to date, and repetitions from the author's former works which we find in it afford some explanation of this. He does not appear to be well acquainted with the modern literature of the subject. One might expect to find some sign of the influence of Mach, but there is none. The framework of the essay is a constructive sketch of the subject, which cannot be regarded as of much value. It is chiefly interesting on account of the satisfactory tone of protest against *a priori* judgments with regard to the principles of dynamics and on account of some attempts which are made to amend the phraseology of the subject, among which "dynamical capacity" figures prominently. It is disfigured by some inaccuracies and obscurities.

It seems, for example, hopeless to attempt to understand what is meant (p. 86) by the fixity of the sun relative to the earth, which we are told would result from the attraction between the sun and the earth losing its reciprocal character. And the explanation (p. 134) of the mechanical equivalent of heat by the example of the coal consumption required for working an elevating machine, as compared with that required for raising the temperature of water, is not a happy one, even with the addition of a parenthetical reference to unavoidable losses.

The author thinks that there has been too great a tendency among the writers of treatises on dynamics to deal with the subject as a merely abstract science, with but little reference to the basis supplied by the observed motions of actual bodies. But he omits to notice what has perhaps been the most unsatisfactory feature of such treatises, namely, their frequent neglect to deal with the question of the establishment of a base relative to which to measure motions for the purpose of the laws of motion, obscurity thus arising with regard to a fundamental point. Indeed, the book before us affords as good examples as could be found of obscurity due to an attempt to construct statements dealing with the motion of actual bodies without clear specification of the base employed.

In the treatment of dynamics as an abstract science, a base may be assumed at the outset, without any reference to the question whether or how such a thing can actually be identified in nature; but so long as this question is postponed, any comparisons with actual motions are apt to be inaccurate or puzzling. Newton's adoption of the postulate of an "absolute motion," as he called it, stands in the forefront of his statement of the theory. He expounded what he meant by absolute motion sufficiently for his purpose, and for a time his followers were content to accept his statement. But a stumbling block was found in the use of the word "absolute," and this word fell into disuse without any more appropriate terminology taking its place, and thereupon the point in question, instead of taking the first place in any statement of the theory, fell so much into the background as to be in danger of being overlooked altogether. The fact remains that the so-called laws of motion apply only to motions relative to a suitably chosen base, one which is probably connected with other phenomena of physics, but may naturally, and must in the first instance, be regarded merely as a creature of the theory, with no right to a title involving such words as "absolute" or "fixed."

THE DISCOVERY OF JAPAN.

Geschichte des Christentums in Japan. Von Pfarrer Hans Haas. I. Erste Einführung des Christentums in Japan durch Franz Xavier. (Tokyo, 1902.)

In this large octavo volume of 300 pages, admirably printed at the Rikkyo Gakuin Press, we have the first instalment of what promises to be as full and accurate an account of the discovery of Japan and of the rise, course and downfall of Christianity in that country during the sixteenth and following centuries as the accessible materials render possible. A distinguishing feature is the extent to which native sources of inform-

NO. 1724, VOL. 67]

ation have been consulted, and though these are neither ample nor very trustworthy, their use lends an interest and an authority to the work which are lacking to the results of previous efforts to present the subject to European readers.

The first notice of Japan was brought to the west by Ser Marco Polo. In a passage pregnant with consequences to East and West, he, or his literary friend to his dictation, writes:—

"Zipangu (*Jihpēnkwo anglice Jippunkwo, i.e. Orient Land*) is an island in the high seas lying eastward [of China] it is of great extent the inhabitants are idolaters and independent. And I can tell you that the quantity of gold they possess is inexhaustible the exportation is forbidden hence they have an immeasurable surplus of gold."

It is not too much to say that the Venetian traveller's words, scouted in his own day, led to the discovery of America, and to the discovery and temporary Christianisation of Japan. Marco Polo's travels were printed in 1477. What he wrote about "Zipangu" came to the ears of Columbus through Toscanelli, and in 1492 the great navigator sailed westwards to discover the great eastern island about which his contemporaries thought him "extravagant and clean possessed." It was his Ophir, and such he held it to be to the end of his days. Yet the wealth of Japan was a mere fable—even in 1887 its production of gold did not surpass some 500 kilos. It was thus a delusion that led to the discovery of America, or rather prepared the way for that discovery of the Pacific Ocean which proved America not to be a portion of Eastern Asia.

For the discovery of Japan the world had to wait another half-century. It was not the result of design, but indirectly of the division of the undiscovered world by Pope Alexander VI., in 1493, between Spain and Portugal, in return for their armed support of the Roman system—probably the biggest deal the world has seen—and directly of the shipwreck, in 1543, of a Chinese piratical junk having three Portuguese deserters on board on the shores of the island of Tanegashima, lying south of the southernmost point of the island empire. As early as 1508, as Mr. Donald Ferguson has recently shown in his interesting "Letters from Portuguese Captives in Canton, 1534-6," Lopes de Sequeira had been ordered to inquire after the Chijns (Chinese), and in 1517 definite commercial relations were established with Canton. Galvano and Xavier both mention the discovery, but the various accounts, including the Japanese, differ as to time and locality. Nevertheless, it is pretty certain that it took place as above stated, and to this day in Japan "Tanegashima" means a gun or pistol.

But in his famous Peregrinação, Fernão Mendez Pinto lays claim to the discovery as his own—through the mischance also of the Chinese junk, on which he was taking a passage from "Sanchan" to "Lailo" with two companions, being driven by stress of weather to seek shelter off the same island of Tanegashima. Pinto was dubbed by Cervantes the Prince of Braggarts, and our own Congreve uses him as a type wherewith to compare a "liar of the first magnitude." A letter of his own and others of his brethren of the Society of Jesus in which we should expect to find some reference to this exploit